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Hunger and obesity: Is this the best we – food scientists/engineers - can offer to the world community in the 21st century?

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Abstract

During the past decades a tremendous input of human and financial resources has resulted in great scientific and technological achievements regarding the production, processing and handling of food. Today's consumers are offered a vast variety of reasonably priced, nutritious food products that can promote their health and guarantee their well-being; yet, the net result of this abundance is not what would be expected. The developed world lives through a striking paradox: suffering and dying from abundance of food! An increasing percentage of people in developed countries is suffering from a series of diet-related diseases (i.e. obesity, cancer, diabetes, cardiovascular disease, osteoporosis) leading to poor quality and/or loss of life. At the same time millions of people in developing countries keep suffering from lack of food, leading to starvation, malnutrition and death before reaching adult age, although the world agriculture is producing enough food for everyone in the world. To a growing extent this reality also refers to people in affluent countries, including the US. All in all, a major part of the world population is split between hunger and obesity! Is this an acceptable situation for the community of Food Sciences? This presentation will analyse the world food problems in both developed and developing countries, focusing on the causes, the suggested remedies as well as the challenges and opportunities for the food science community. The fundamental approach is looking for possibilities to drastically improve the positive impact of coordinated efforts for a better and healthier world; a world that will not be split between hunger and obesity.

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1. Introduction

Thanks to the valuable input of thousands of dedicated researchers, Agricultural and Food Sciences have scored a tremendous progress in several, rather challenging fields regarding the production,

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processing and handling of food. Despite this progress, however, in one way or other food remains the number one problem all over the world. Millions of people in developed countries literally "commit suicide" through over-consumption or wrong use of food, leading to obesity and a long list of food related diseases. At the same time people in developing countries keep suffering from lack of food, leading to starvation, malnutrition and death before reaching adult age. To a growing extent this reality also refers to people in affluent countries, including the US. According to the United Nations Development Program, nearly 3 billion people (40% of the world's population) live on less than $2 a day [1]. All in all, a major part (possibly the majority) of the world population is split between hunger and obesity!

This situation is questioning the social benefit of so many and great scientific achievements of our (food science) community. If we are doing so well with production, processing and handling of food, why so many people keep suffering because of food? What exactly causes and sustains the world hunger problem? Where is our input as food scientists and fellow citizens? What are the main causes of wrong eating habits leading to the obesity "epidemic"? What is the share of responsibility for each and every "player" (stakeholder) in this "game"? What is our share of responsibility and how can we better serve the fight against the world food problems? Can we all join forces to work for a new world, where food is not a problem leading to death, but a holy gift supporting life? These are some of the questions that this paper will try to address.

2. Food problems in developing countries

According to an FAO report, it is estimated that 1.02 billion people out of 6.8 billion of the present world population is suffering of hunger; that is 15% of the world! Compared to the 2006 estimate of 854 million hungry, this is a tremendous increase within a very short time; an alarm for negative developments to come [2]. It is also estimated that more than 24,000 people, mainly children below 5 years of age, die daily of hunger [3]; at the same time millions are suffering from malnutrition and/or lack of clean (potable) water. According to the United Nations Development Program, nearly 3 billion people (40% of the world's population) live on less than $2 a day; in a worse case senario, a family of six in Chad lives on a total US$1.22/week [1].

What really causes and sustains the world hunger problem? Is it lack of adequate food? A recent study revealed that, world agriculture is producing 17 % more calories per person today than it did 30 years earlier, despite a 70 % population increase. This is enough to provide everyone in the world with at least 2,720 kcal per person per day [4]. As Amartya Sen (1998 Nobel prize in Economics) has clearly put it: "The world supply of food is sufficient to feed the world population; simply food is not where needed, when it is needed"

Why is that? Is it questionable care by world leaders? Is it lack of social awareness and fellowship? Is it lack of respect for human rights, including that of access to food?

It appears that all the above are true to a certain extent. All in all, it is lack of adequate care and/or coordinated action of those who can help for those who suffer!

It is well accepted that, the world hunger problem is highly complicated due to political, social and economic reasons. Nevertheless, the scientific community shares a great responsibility in shaping the right political decisions and informing the society about the impact of world agricultural or trade policies on production and availability of food in developing countries. Biofuel production, for instance, will naturally have a negative impact on food availability and food prices, as long as it is allowed to compete against food production. Land based agriculture should not be used for biofuel production, as land is an increasingly limited resource needed for the food supply of an increasing world population. Aquaculture could certainly be considered as an alternative domain for biofuel production. Research on algal biofuel production has given encouraging results [5], especially when such production is coupled to the use of wastewaters [6].

On top of other substantial reservations (i.e. environmental impact, biodiversity, sustainability, freedom of choice, etc), GM food can lead to concentration of world food control in fewer hands and to radical changes in traditional agriculture (i.e. absolute dependence on specific seed supply; loss of local varieties and valuable genetic resources). Such changes constitute major threats to the world food security.

Climatic changes, desertification and massive rending of land in developing countries by large agro-food companies to produce biofuel or food for export, are expected to further complicate the world hunger problem. Although in a free economy rending of land is a lawful practice, it cannot be considered an ethical one, since an already limited resource, such as land, is taken away from people starving to death.

The above challenging issues pose unique opportunities for Food Scientists/Engineers to contribute in the fight against the world hunger problem. As P. E. Nelson, the 2007 World Food Prize Laureate and past president of IFT, has recently put it [1]: "Scientific and technological advancements must be accelerated and applied in developed and developing nations alike, if we are to feed a growing world population". Our scientific society can contribute through well-organized, collective actions. Agronomists can work on improving local plant varieties that are suitable for extreme soil and weather conditions in TW countries. Modern tools such as satellite surveillance of food crops in problematic areas can help predict and prevent famines. Agro-food engineers could work on development and optimization of alternative, sustainable systems of biofuel production, thus saving valuable land for food production. Food scientists/engineers/nutritionists can work on developing food formulations and processes for inexpensive, nutraceutical-type products, to be used as "complete, balanced meals" (i.e. reconstituted drinks, stable dry meals). Establishing an open forum and a task force on the "World Hunger Problem" could be a reasonable approach in joining forces to combat hunger and malnutrition in a food-insecure world.

3. Food problems in developed countries

Our society lives through a contradictory reality: a large and increasing percentage of population in developed countries suffers while living with abundance of food. This is due to over-consumption and/or wrong use of food that leads to obesity and nutrition-related chronic diseases. In 2000, the World Watch Institute reported that for the first time in history, there were just as many overfed people on the planet as underfed [1]. The following food-related issues need to be addressed in developed countries:

- Wrong eating habits and diet related diseases
- Food safety problems (food crises)
- Mishandling of food by the consumer
- Oligopolies in food market control
- Limited access to food in developed countries, due to increasing poverty

3.1. "Wrong eating habits", obesity and diet-related diseases

"Wrong eating habits" lead a sizable portion of population to poor nutrition and diet related, health problems. The so called "Western" style of eating results in high intake of calories, sugar, salt, animal fat, trans-fatty acids (TFA), cholesterol. In turn, a high intake of such ingredients combined with a sedentary style of life leads to a series of "western" type diseases, such as: obesity, diabetes, hypertension, cardiovascular diseases and certain types of cancer. An unbalanced diet can also lead to health problems due to deficiencies; i.e. anemia, osteoporosis, growth retardation, avitaminosis related diseases, etc.

What is in fact obesity? Obesity is actually a modern, "*epidemic*", devastating disease. According to recent IOTF (International Obesity Task-Force) statistics [7], up to 35% of men and 40% of women in certain European countries have a BMI (Body Mass Index) equal or above 30. The new, global

IASO/IOTF analysis [8] estimates that approximately 1.0 billion adults are currently overweight (BMI 25-29.9 kg/m²), while an additional 475 million are obese (BMI≥30). In the European Union 27 member states, approximately 60% of adults and over 20% of school-age children are overweight or obese. This equals to around 260 million adults and over 12 million children being either overweight or obese. Even worse, is the negative dynamics with increasing numbers of people turning from overweight to obese, while more people join the overweight group.

What is rather surprising and dangerous, is people's response to a serious health problem like obesity. Despite the obvious need for professional help and medical treatment, a lot of people deal with obesity in rather superficial, irresponsible and empirical ways; that is without patience to safely lose weight under the guidance of a specialist. Many resort to dangerous diet schemes including monophagia (eating only one food; i.e. grapes) or withdrawal from eating for long periods of time (starvation), while others make themselves believe in easy, *"miracle solutions"* (promised *by "slimming"* centers).

What are the causes for the development of an unhealthy and dangerous style of eating? Among other reasons, wrong eating habits may be due to:

1. *Lack of nutrition and food education*: Rowe et al. [9] presented the results of two expert dialogues to address the problem of translating the Dietary Guidelines for Americans (DGA's) to bring about real behavior change. They suggested children's nutrition education as an optimal starting point for changing adult dietary patterns. In most countries school education on nutrition and food is in fact either limited or absent; therefore, the youngsters are not trained on healthy eating, that would help them develop correct eating habits and grow to become trained parents. Even worse, school canteens are often packed with "junk food" and a series of school activities (including athletics!) are sponsored by "junk food" suppliers (what an irony!). What is more confusing is offering food/nutrition guidance in class and allowing the school canteen to serve "junk food" during the breaks. Last but not least, although balanced nutrition and exercise have been recognized as absolute prerequisites for good health and valuable tools in preventive medicine since the Hippocratic era (460 BC), nutrition education in many medical schools is either missing or inadequate; thus medical education is focusing almost exclusively on curing, while prevention receives very little attention, if any.

2. *Crisis of values and "lack of time"*: They both lead to deterioration of the family fabric and loss of such valuable daily routines, as the *"family table"*. *"Lack of time"* for preparing a healthy meal and sitting around the family table leads to seeking convenience and easy solutions (fast food, TV dinners); more often than ever people eat out and their diet heavily depends on large-sized meals of questionable nutritional quality.

3. *Gradual loss of traditional dishes*: It goes hand in hand with deterioration of the family institution. As a result, healthy, traditional dishes based on sustainable use of food sources and serving as safeguards for a balanced, nutritional diet are gradually lost. At the same time, we are losing a valuable constituent of our civilization, that is food tradition.

4. *Eating for entertainment versus eating for nourishment*: This is especially the case among teenagers. Eating is often considered to be another entertainment activity; therefore adverse health effects are consciously ignored, as long as the chosen "*food*" or drink provides satisfactory entertainment. *"Junk food"* and snacks, soft drinks and alcoholic beverages are representative examples of food and drink choices serving entertainment rather than nourishment. They are also responsible for high intake of salt and sugar, fat and calories and low intake of essential nutrients leading to several nutrition-related diseases.

5. *Over-consumption of food:* For many people eating large quantities of food without discrimination, is a daily routine. This is often the case with low-education, low-income groups and/or depressed people.

6. *Mimicry to follow fashion and style:* Especially young people are vulnerable to media advertisements dictating not only their food choices and style of eating, but also the way they should look (i.e. thin like models). Such behaviors often lead to unhealthy diets with serious health complications, including anorexia nervosa. The great power of media offers enormous possibilities for consumer

manipulation (read *"consumer programming*"); therefore, here lies a great degree of corporate responsibility.

How can we act to modify/improve eating habits? This is a rather difficult and complicated task that needs well-planned, long-term, coordinated actions. Among other interventions there is a need to work on the following objectives:

1. *Introduce or improve food and nutrition education at all school levels* (nursery, primary, secondary). School canteens may present a serious obstacle to effectiveness of this intervention, unless appropriate regulation of their mode of operation is legislatively imposed. Effective teaching tools are needed, emphasizing the use of IT to promote life-long self-teaching. Food Scientists/ dieticians/nutritionist communicators can work together to produce such tools. Special care should be given to teaching children of ethnic groups, where cultural eating trends strongly prevail. Family participation in training programs is fundamental to bringing about eating behavior changes.

2. *Introduce or improve training of medical doctors on nutrition and health*, emphasizing the role of healthy eating as a valuable tool in preventive medical care (prevention vs. curing). Instead of wasting money for uncertain curing/rehabilitation treatments, it pays to invest in prevention.

3. *Offer elective "Food and Well-being" type courses* at University level to non-food science majors.

4. *Increase public awareness for the value of healthy eating and exercise* to health and well-being by all available means, including professionally designed education programs on public communication media; i.e. public radio/TV, properly controled internet sites. Consumer education has been recognized as a main task for the ISEKI-Food Thematic Network [10]. One of its main objectives has been to: *"Establish communication with the general public and the consumers"*. ISEKI-Food Association (IFA) (www.iseki-food.net) has been established as a sustainable continuation of the ISEKI-Food Thematic Network. Among the first tasks of IFA has been to create a database of Food Info for the average consumer in 14 (so far) EU languages [11].

5. *Improve access to nutritional information* for all, especially those missing the scientific background to "*read*" (understand) the information presented in food labels. Besides packaged food items, proper, understandable nutrition labeling should be also applied to restaurant served meals. Proper communication of nutrition information to all customers (independent of education level) requires extensive simplification of the labeling "*language*", making use of simple symbols or ways to indicate whether a food item is promoting or hurting good health. While this is helpful to every buyer, it is essential to low-education population groups, as they are more vulnerable to wrong use of food.

6. *Conduct clinical nutrition studies* and develop relevant databases to timely recognize and prevent the development of unhealthy eating patterns. Based on such studies, proper intervention policies and effective measures can be designed and implemented.

7. *Legislate and enforce "corporate (producer) responsibility"*. All the above measures have a significant cost of implementation, but the cost of medical care for those suffering of obesity and diet related diseases is dramatically higher then the cost of prevention. In the same way that tobacco companies are liable for covering the cost of medical care induced by smoking, food companies are liable for covering the cost of medical care induced by the use of unhealthy products. This is a fair and safe way for forcing food producers to improve the nutritional profile of their products; especially as voluntary actions of the food industry for nutritional improvements have not been satisfactory. A recent study proved that the world's top 25 food companies failed to live up to their pledges to cut down on sugar, salt, trans-fat, cholesterol, serving sizes and calories [12, 13] The companies that appeared to be doing the most were the ones under intense pressure because of their unhealthy product range.

The need for thorough scientific documentation (i.e. clinical nutrition studies), that will dictate appropriate state policies and well as required legislative actions to effectively implement them, points to the catalytic role that food scientists/dieticians are expected to play in facing this devastating problem. There is an urgent need of suitable educational tools for several, highly different audiences, including children, students, uneducated adults. Co-operation of scientists and communicators with complimentary

expertise is essential in building suitable vehicles for effective "*translation*" of nutrition guidelines into healthy eating behavior.

3.2. Food safety in a globalized world

In a globalized economy, food market control is passing in fewer and fewer hands, leading to colossal concentration of market power. With $120 billion in annual revenues, Cargill is bigger than the economies of more than two-thirds of the world's countries, including Kuwait, Peru and Vietnam. Its sales exceed those of Disney, Kraft Foods and PepsiCo (combined) and it is nearly twice as large as its next closest competitor, Archer Daniels Midland [14]. The urge for improved competitiveness to gain distant markets is increasing and sets the scene for a dangerous shift in production priorities. Instead of focusing in production of food with high safety, satisfactory quality and acceptable cost, the "competitive market ethics" call for the reverse order of priorities; that is, food of low cost, acceptable quality, questionable safety. "Food safety" is acquiring new dimensions. As a result, during the last two decades the world has been faced with a number of food crises, including BSE ("crazy cow disease"), dioxins, acrylamide, growth hormones and antibiotics, all related to newly developed, highly intensified production methods. These crises have taken a severe toll on reliability of the food industry and the state monitoring authorities. It is time to reconsider and redesign our production objectives. In order to secure safe food, at primary production level we need to further develop and encourage the use of sustainable production methods, that will safeguard against new food crises and raise reliability of the "food industry" in the consumers' eyes.

3.3. Food safety and the role of the consumer

At consumer level we need to help improve consumer awareness on real values of food (nutrition, quality, safety). Consumer education is a basic consumer right and an absolute pre-requisite for safe handling of food by the consumer. Mishandling of food by the consumer will easily cancel every effort and achievement of the Food Industry with respect to quality, nutritional value and safety; thus canceling the positive impact of valuable achievements in food research (that is, the impact of our own work!). An importance analysis of factors affecting milk spoilage showed that a better temperature control of domestic refrigerators is the most effective action for extending shelf life, compared to a better control of hygienic conditions during production or a better temperature control in the retail chain [15].

3.4. GM-food and food market control

Food from genetically modified organisms (GM-food) has raised serious questions with respect to environmental impact, biodiversity, bioethics, safety and respect to consumer rights regarding free-informed choice of food. The latter is calling for obligatory labeling. The demand of the European consumer for labeling of GM-food and the objection of the US side to such a commitment has lead to a long series of US – EU disputes, that still remain unresolved. Besides the above issues, the gradual dislocation (eventual extinction) of local, well-adapted varieties of staple foods poses a severe threat for losing valuable genetic resources. On the other hand, the growing dependence of the world population on a small number of GM varieties exclusively offered by certain seed suppliers can lead to dramatic, irreversible developments in world food market control with unpredictable dimensions and severe impact on the survival and independence of developing countries.

4. Epilogue

Our spiritual fathers have resembled human capacities and talents to a useless *"half scissors",* if they are used without virtue. We need to add virtue to our scientific endeavors, if we want to turn our great capacities into *"complete, functional scissors"* that will help the world community face its devastating food problems. Let us join forces to contribute towards a shared vision that is a better and healthier world, a world that will not be split between obesity and starvation. After all, our accomplishments as Food Scientists will always be measured against a unique humanitarian task: *"Access to safe food and healthy eating for all"*.

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